WHAT IS CLAIMED IS:

1. A scanning probe microscope comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever;

a variable amplifier for adjusting gain of the signal; and

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means,

wherein the variable amplifier adjusts the gain of the signal so as to control Q in the vicinity of the resonance of the cantilever for an optimum value with respect to change in environment.

2. The scanning probe microscope according to claim 1, wherein the variable amplifier adjusts the gain to

$$G = (A/A_0) \times G_0$$

in the case of setting an arbitrary oscillation amplitude A when the gain G=Go in the case of controlling $Q=A_0$ using Q control at a certain oscillation amplitude A_0.

3. The scanning probe microscope according to claim 1, wherein the variable amplifier exerts control such that the gain G becomes small using the relationship.

$$G \propto 1/L$$

4. The scanning probe microscope operation method of claim 1, comprising the steps of:

dummy approaching a probe to a sample for acquiring a zero

point (Z_E) for a distance between the sample and the probe;

raising the probe by just ΔZ taking the point (Z_E) as an origin, controlling the Q value at this position so as to set the desired Q value; and

separating the probe and the sample by just a microscopic distance, re-measuring the Q-curve after a dummy approach, and making another approach.

5. An operation method for the scanning probe microscope of claim 1, comprising:

a step 1 of measuring a Q-curve, controlling Q=Q1 and taking Q-control parameters (Q control gain etc.) at this time as G=G1;

a step 2 of continuously measuring a Q-curve, controlling the Q-value to be Q2 (where Q2>Q1), and taking Q-control parameters (Q-control gain, etc.) at this time as G=G2;

a step 3 of setting parameters of G=G1 and measuring shape using a low Q-value of Q=Q1; and

a step 4 of next setting parameters of G=G2 and measuring gradient of magnetic force using a high Q value of Q=Q2, wherein response is improved by performing shape measurements using a low Q-value by repeating step 3 and step 4 each line or each pixel, and magnetic force gradient sensitivity is improved by measuring magnetic force gradient using a high Q-value.

6. A scanning probe microscope comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever;

a variable amplifier for adjusting gain of the signal so

as to control Q in the vicinity of the resonance of the cantilever;

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means,; and

a phase measurement unit with a phase signal of the cantilever and a reference oscillation output of the oscillator are connected to input terminals and a phase difference of the signals is detected by the phase measurement unit and outputted as phase data.

7. A scanning probe microscope comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever;

a variable amplifier for adjusting gain of the signal so as to control Q in the vicinity of the resonance of the cantilever;

a voltage-controlled oscillator forcing a cantilever to be oscillated;

an adder for superimposing an output signal of the variable amplifier with an output signal of the voltage-controlled oscillator forcing a cantilever to be oscillated; and

a phase comparator having at least two input terminal,

the phase comparator is input a variable detection signal of the cantilever to one input terminal and a reference oscillation output signal from the voltage-controlled oscillator to remaining input terminal, compares phases of the two signals, and outputs a voltage value corresponding to

frequency data used as a frequency data and a voltage control signal for the voltage-controlled oscillator.

8. A scanning probe microscope comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever;

a variable amplifier for adjusting gain of the signal so as to control Q in the vicinity of the resonance of the cantilever;

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means; and

a phase comparator and voltage-controlled oscillator with a variable detection signal of the cantilever is inputted to one input terminal of the phase comparator, and a reference oscillation output signal from the voltage-controlled oscillator is input to the remaining input terminal, the phase comparator compares phases of the two input signals and outputs a voltage value corresponding to frequency data that is used as frequency data, the phase comparator is connected so that the voltage value is sent to an input terminal as a voltage control signal for the voltage-controlled oscillator, and the output signal of this voltage-controlled oscillator is used in place of the oscillator as a forced oscillation drive source of the cantilever in frequency measurement mode.

9. The scanning probe microscope according to claims 1, further comprising a filter for blocking high order frequency

components of a fundamental oscillation in a control loop comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever; a variable amplifier for adjusting gain of the signal; and

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means.

10. The scanning probe microscope according to claims 6, further comprising a filter for blocking high order frequency components of a fundamental oscillation in a control loop comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever; a variable amplifier for adjusting gain of the signal; and

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means.

11. The scanning probe microscope according to claims 7, further comprising a filter for blocking high order frequency components of a fundamental oscillation in a control loop comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever; a variable amplifier for

adjusting gain of the signal; and

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means.

12. The scanning probe microscope according to claims 8, further comprising a filter for blocking high order frequency components of a fundamental oscillation in a control loop comprising:

extraction means for extracting speed from a vibration detection signal of a cantilever; a variable amplifier for adjusting gain of the signal; and

an adder for superimposing an output signal of the variable amplifier with an output signal of an oscillator normally occurring in a dynamically driven method for forcing a cantilever to be oscillated by piezoelectric means.